



European  
Commission

Horizon 2020  
European Union funding  
for Research & Innovation



European Research Council  
Established by the European Commission



Research Foundation  
Flanders  
Opening new horizons

Infosession FET Open en Proactive

# SHERO: Self healing soft robots

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VRIJE  
UNIVERSITEIT  
BRUSSEL

**brubotics**<sup>®</sup>  
Brussels Human Robotic Research Center



BramVDBorgh



# Paradox of Moravec



Darpa Robotics Challenge



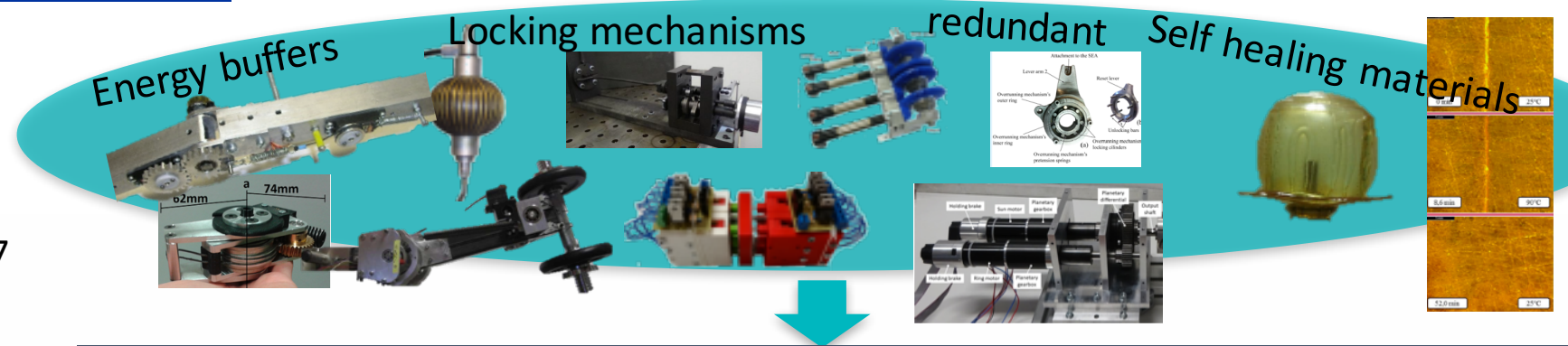
Need for human-robot interaction

Inspiration of nature for safe and energy efficient actuation



## Safe, Strong and Energy efficient and self healing Actuators

Partner in Brubotics  
Core lab Flanders Make  
EiC Robotics & Automation Magazine  
Book and events: Homo Roboticus

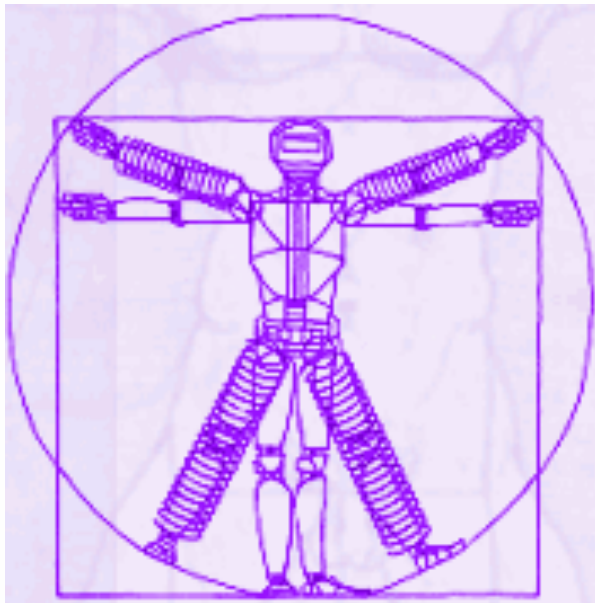


## Robots interacting with dynamic and unknown environments including humans

## Manufacturing

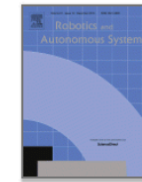


# Viactors FET Project (2009)







## Robotics and Autonomous Systems

Volume 61, Issue 12, December 2013, Pages 1601-1614



### Variable impedance actuators: A review

B. Vanderborght<sup>f</sup>    , A. Albu-Schaeffer<sup>a</sup>, A. Bicchi<sup>b, e</sup>, E. Burdet<sup>d</sup>, D.G. Caldwell<sup>e</sup>, R. Carloni<sup>c</sup>, M. Catalano<sup>b, e</sup>, O. Eiberger<sup>a</sup>, W. Friedl<sup>a</sup>, G. Ganesh<sup>d</sup>, M. Garabini<sup>b</sup>, M. Grebenstein<sup>a</sup>, G. Grioli<sup>b</sup>, S. Haddadin<sup>a</sup>, H. Hoppner<sup>a</sup>, A. Jafari<sup>e</sup>, M. Laffranchi<sup>e</sup>, D. Lefeber<sup>f</sup> ... S. Wolf<sup>a</sup>

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<https://doi.org/10.1016/j.robot.2013.06.009>

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### Abstract

Variable Impedance Actuators (VIA) have received increasing attention in recent years as many novel applications involving

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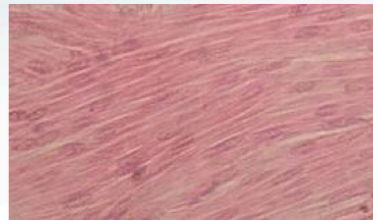
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## First dreams: workshop FET Flagship (2011)

*Cor*



Modularity on s  
"Transistor for a

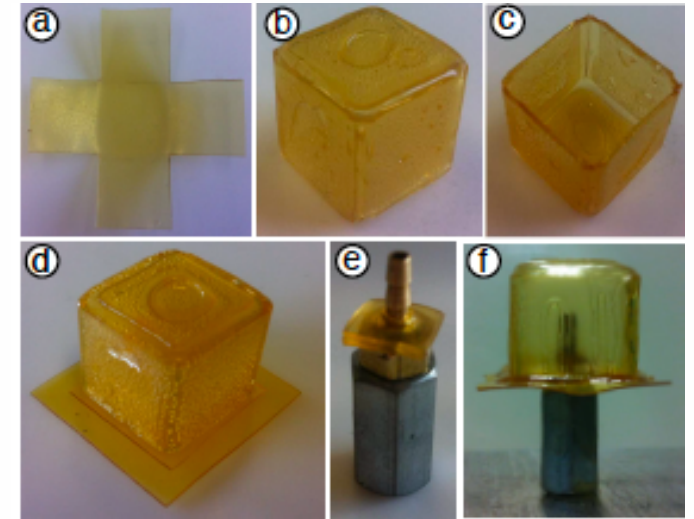
## *Open issues*

- New materials
- New production processes (multi-material printing?)
- End of life of robots, recycling, avoid scarce materials (use Fe, Si, C, H, O,...)
- Growing + self healing materials



## Steps

- Xmas party family 2012?
- Ma1 project and master thesis
- ERC support
- Strong collaboration between robotics - materials
- FWO mandate Seppe, FWO project AMSER
- FET project feb 2015: first submission
- 6 maal submitted 4.8, 4.05, ?, 4.3, 4.25, 4.6
- Introduction company, budget reduced
- 1 June 2019: project started

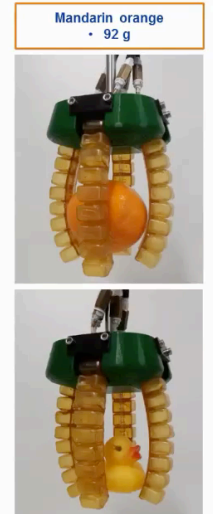
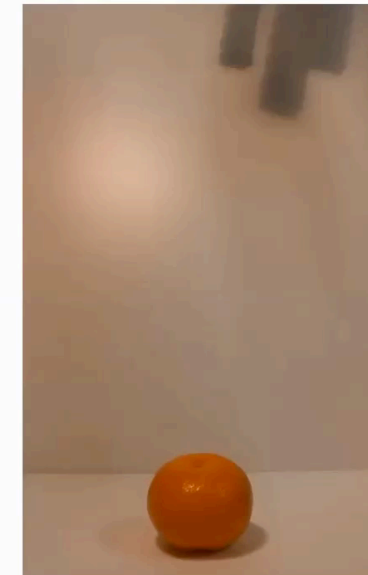
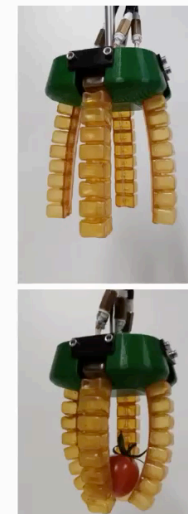
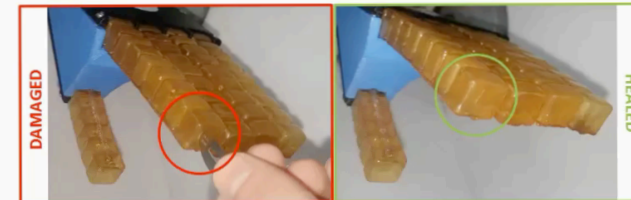
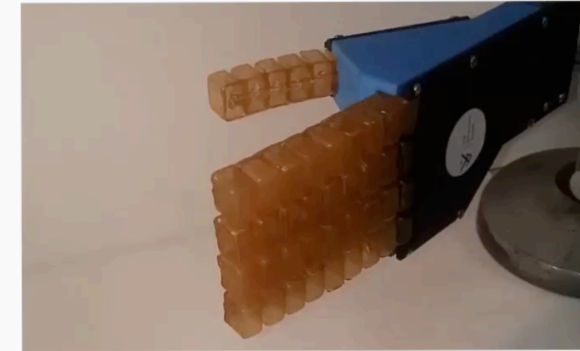
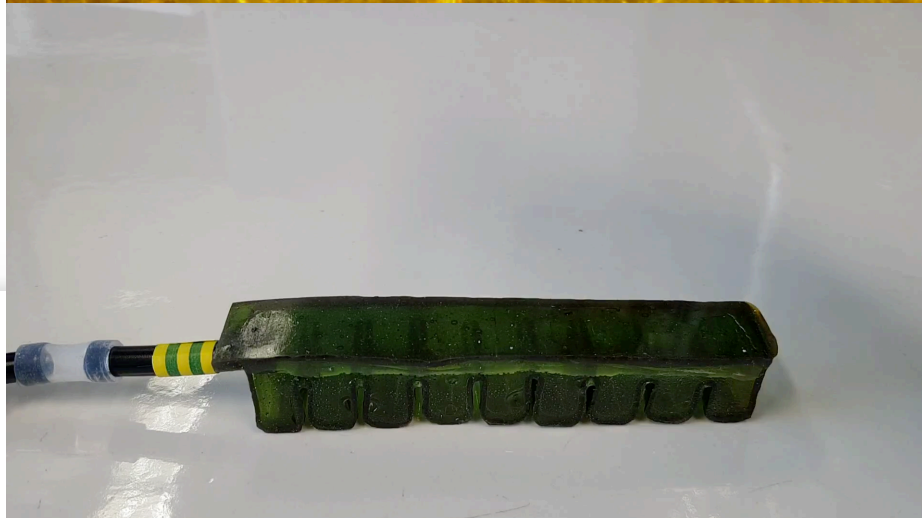
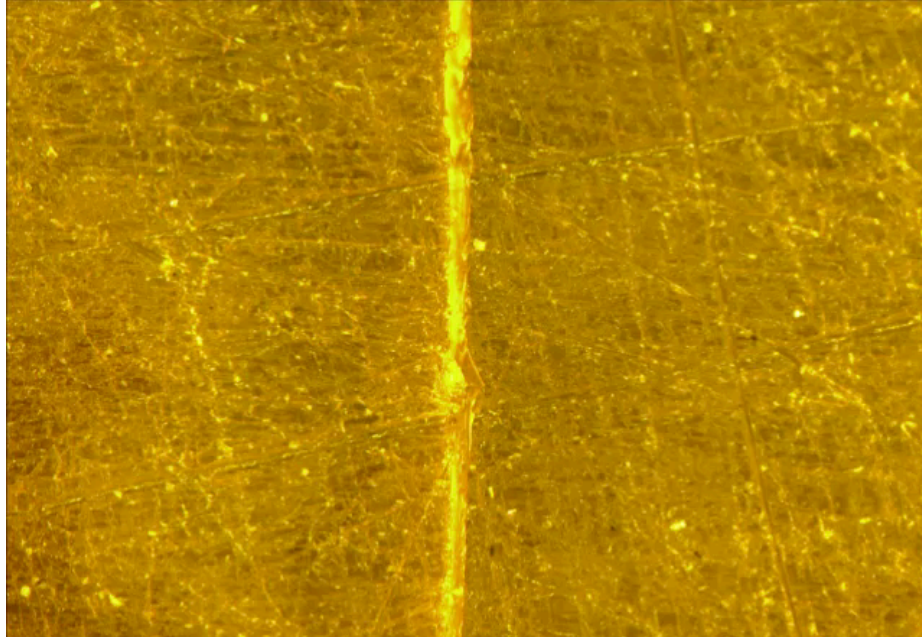


## Self-Healing Soft Robotics

A Horizon 2020 FET Open Project (Grant Agreement ID: 828818).



# Self healing soft actuators



Mandarin orange  
• 92 g



## Compliance with FET call

FET most optimal funding program

High-risk, novelty, needs interdisciplinary team, international collaboration

- Radical Vision
- Breakthrough technological target
- Ambitious interdisciplinary research

Demonstrator not the innovation, the underlying technology concepts will be

High risk, but we have feasibility studies, will work on parallel roads  
robotics+material sciences, evolve to transdisciplinary research field:  
self healing robotics

Inclusion of a company as partner

## Why FET?

FET most optimal funding program

High-risk, novelty, needs interdisciplinary team, international collaboration...

# Press interest during launch

## Soft Self-Healing Materials for Robots That Cannot Be Destroyed

It'll take more than having its fingers chopped off to stop this robot hand

By Evan Ackerman

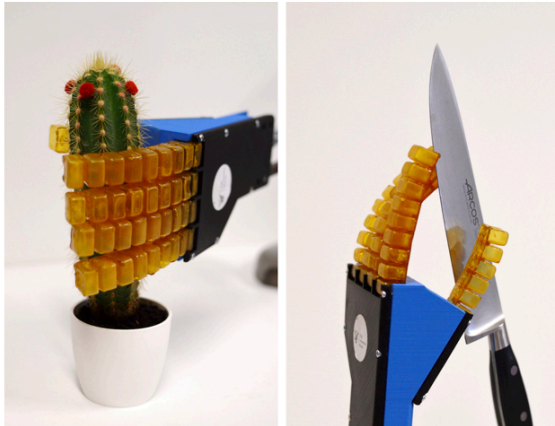


Image: SHERO Project  
This robot hand can autonomously heal itself over and over again.

If there's one thing we know about robots, it's that they break. They break, like, literally all the time. The software breaks. The hardware breaks. The bits that you think could never, ever, ever possibly break end up breaking just when you need them not to break the most, and then you have to try to

DeMorgen.

ROBOTS

## Robot kapot? Geen probleem, hij herstelt zichzelf



Baymax uit 'Big Hero 6'. Beeld rv

MARKETS BUSINESS INVESTING TECH POLITICS CNBC TV

## Self-healing robots? Experts are developing machines that can detect and repair their damage

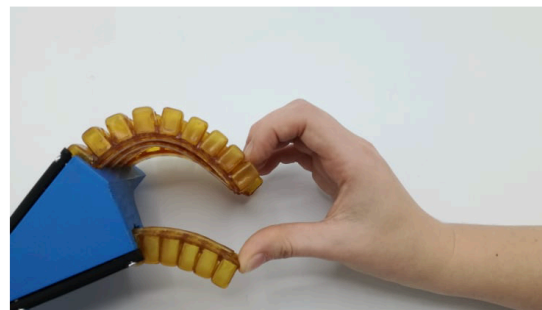
PUBLISHED THU, AUG 8 2019-7:42 AM EDT | UPDATED THU, AUG 8 2019-11:35 AM EDT

Anmar Frangoul

SHARE f t in e ...

**KEY POINTS**

- Today, robots are being used to carry out delicate tasks, such as picking strawberries or apples, which have usually been the preserve of humans.
- Researchers in Europe are working on a project to develop robots that can detect damage and then "heal" themselves.



VUB | Brubotics

This article is more than 1 month old

## Robot, heal thyself: scientists develop self-repairing machines

EU project creates robotic hands that can sense and fix damage without human intervention

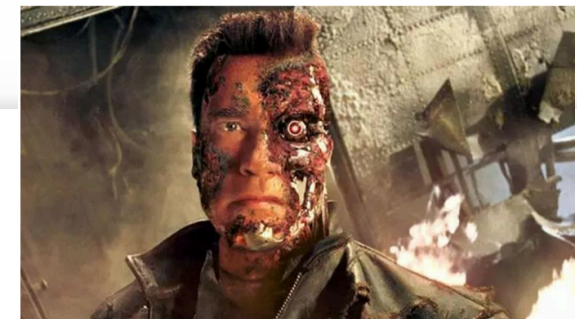


Nieuws > Binnenland

## Studie VUB: robots kunnen nu ook eigen beschadigingen herstellen

avh | 16 augustus 2017 | 22u23 | Bron: België

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# New dimensions to self healing robots

- Collaboration, research mobility
- New materials
- New processing techniques
- Development actuators and sensors
- Using AI techniques for sensor processing and control

## Tips

Think well about the project idea, invest in it

Show the underlying scientific principles

Not based on idea with deus-ex-machina technology (eg spray some graphene over it)

Check Technology Readiness Level

Choose excellent partners

Start on time, allow time for project to grow

Most of writing is for coordinator...

Develop the proposal till the details (impact, dissemination,...)

Write for experts, but maybe not necessary experts in your field

Do not be afraid of low acceptance ratios

Do not give up